

Quarterly Eos Contract Report - Report #27

Period: January 1 - March 31, 1994

Remote Sensing Group (RSG),
Optical Sciences Center, University of Arizona

Principal Investigator: P. N. Slater

Contract Number: NAS5-31717

Report compiled by: K. J. Thome

Task Progress:

P. Slater and P. Spyak travelled to Washington, D. C. for a MODIS In-flight Thermal IR Calibration Algorithm Workshop and to review with P. Menzel the status of and inputs to the MODIS Calibration Plan on January 13 and 14. Slater sent a letter to V. Salomonson regarding follow-up to the IR action items. S. Biggar and Spyak attended the MODIS CDR at Santa Barbara Research Center on January 18-20. Both Biggar and Spyak sent comments about the review to Salomonson and R. Weber. Slater and Spyak attended the MODIS Calibration Plan meeting at GSFC on March 3. Biggar and Slater attended and gave five presentations at a dry run of the MODIS Calibration Plan Review at GSFC held March 16 and 17.

Slater and K. Thome travelled to Pasadena for the ASTER ATBD Review Meeting at JPL February 17 and 18. Thome presented the ATBD for the atmospheric correction in the solar reflective. Slater wrote a report, part of which was forwarded by A. Kahle to M. King, P. Sellers, and V. Salomonson, regarding preflight, algorithm cross-comparisons. Thome met on February 15 with B. Eng, C. Voge, and M. Pniel to discuss the atmospheric correction development status and plans. It was agreed that the Remote Sensing Group should have the capability to develop the look-up table and that a target run-time for generating the table should be 3 months with a maximum of 5 months. Biggar and Thome are currently examining the hardware requirements to do this and will include these in our updated SCF requirements document. Thome also met with F. Palluconi of JPL and T. Takashima of MRI on February 16 to discuss the status of the atmospheric correction algorithms. Slater and Thome attended an ASTER Level-1 ATBD meeting held at JPL March 7 and 8. Slater sent comments to Kahle regarding the radiometric calibration portion of the ATBD.

Thome travelled to San Antonio for the EOS IWG meeting January 11-13. Slater attended the Spectral Signatures meeting in Val d'Isere, France during the week of January 17. He presented a paper co-authored by Biggar and Thome titled "Unified pre- and in-flight calibration of satellite sensors." Biggar attended the IVOS WGCV CEOS meeting in Seattle held February 22 and 23. Slater submitted two sections to A. Ono's calibration paper and submitted

a title and abstract to Fujisada's session on Level-1 ASTER processing for the Rome SPIE meeting in September of this year. From February 28 to March 2, Biggar, Slater, and Spyak attended the EOS Calibration Panel meeting in Rockville and the MOPITT calibration peer review. Spyak presented early thermal transfer radiometer design considerations at the EOS Calibration meeting. On March 3, Biggar inspected a mobile laboratory at NSA with a view to acquiring it for field calibration purposes. Biggar, Slater, and Spyak revised the group's budget input for both ASTER and MODIS in March. The new budget will require a reduction in scope of work.

The group hired B. Ernie Nelson as an additional staff person during the month of February. Nelson's primary duties are to help with instrument assembly and repair, and to aid in equipping our calibration and instrument assembly facilities. He spent much of the month acquainting himself with the group's equipment and facilities. He aided Spyak in determining the materials needed for the calibration facility. Biggar and Nelson began work on a sample and hold device for aircraft-based radiance measurements. Nelson also repaired the wiring in the blacklab shunt and reinstalled it. He and Biggar documented the design of the cross-calibration transfer radiometer built by Biggar for the visible and near-infrared part of the spectrum. They also investigated possible designs for a smaller, more portable power supply for the radiometer. A drill press was purchased for our instrument assembly laboratory.

D. Gellman and Thome examined the possible effect of the reflectomobile's tire tracks on the surface reflectance measurements for the reflectance-based vicarious calibration. Gellman is studying the problem further and investigating possible solutions. He also continued work on specifying the mobile laboratory. He examined the feasibility of obtaining a surplused mobile laboratory and is continuing to explore this possibility. We have also decided to explore redesigning the mobile laboratory because of the lack of response to our first design. Gellman began looking at the possibility of mounting the reflectomobile to the truck in an attempt to reduce instrument vibration. Gellman made preparations for a late March, early April, White Sands trip. He worked on the software for retrieving surface reflectance measurements in the field and measured/calibrated our field reflectance panels.

Spyak and Slater worked on combining the inputs to the MODIS Calibration Plan. The first version of the document was delivered to GSFC on March 25. Spyak continued investigating thermal cross-calibration radiometer designs. He reviewed the MODIS and ASTER specifications to determine the transfer radiometer's design requirements. Software was written to analyze radiometer designs, and Spyak began preparing a questionnaire on thermal transfer radiometers that is to be sent to members of the EOS Calibration Panel. During the March budget exercise mentioned above, it was decided not to construct thermal radiometers that would operate in

thermal vacuum because the budget cuts would not allow adequate radiometers to be built. Spyak also reviewed MODIS calibration techniques presented at the CDR and investigated video camera systems which will be used for geo-referencing aircraft-based radiance measurements. He ordered a micro-video camera and hand-held VCR for this purpose.

Work on our calibration facility continued with Spyak ordering two monochromator attachments for transmittance measurements in the wavelength range of 0.2-6.0 micrometers. He also purchased optical hardware for the laboratory. Biggar and Spyak began measurements to characterize the light leakage of the Optronic monochromator and started measuring the filters for the silicon-cross-calibration radiometer. During these measurements they determined that the Optronic monochromator was not functioning properly and they returned it to the manufacturer for repair. Gellman and Spyak sent the blacklab shunt and multimeter to the manufacturer for calibration. Biggar ordered and received a 24-bit digital-to-analog converter for the blacklab to enable us to further automate our laboratory reflectance panel calibrations. He also ordered a highly accurate "transfer standard" voltmeter for the laboratory. Biggar received and began evaluating a portable 6-inch spherical integrating source from Labsphere for use as a travelling standard for the VNIR and SWIR cross-calibration radiometers and a 40-inch spherical integrating source from Labsphere for instrument calibration/characterization. He also worked on improving our radio link connection the University ethernet system and evaluated newly received computer hardware.

Thome spent much of the period working on the ASTER ATBD for the atmospheric correction in the solar-reflective part of the spectrum. He sent the final draft version to Kahle on February 27 along with a cover letter for the Atmospheric Correction ATBDs. An iterative version of the radiative transfer code was completed and a copy emailed to Eng. Thome sent preliminary comments on the software requirements document to Voge and sent G. Geller of JPL inputs to the Standard Data Product Specification for ASTER. Thome sent final atmospheric transmittance results from the November SeaWiFS solar-radiation-based calibration to A. Holmes and completed work on the calibration. He also completed the calibration of Landsat-5 based on the data collected last October.

Work on the diffuse-to-global instrument has consisted of B. Crowther further developing the Monte Carlo code which models scattering in spherical integrating sources (SIS). He currently is able to model the scattering of a general, idealized SIS, Labsphere's SIS, and modified SIS designed by Crowther. The goal of this modeling is to try and develop a cosine receptor for the diffuse-to-global instrument.

Eight members of the group travelled to White Sands for satellite calibration work for SPOT-2, SPOT-3, and Landsat-5. We were accompanied by T. Clarke and M. Moran of the USDA ARS Water Conservation Lab in Phoenix. In addition to the calibration work,

the trip was also used to examine possible new sites which could be used when the mobile laboratory is complete. We also used the trip to re-evaluate the use of yokes as a method for transporting instruments over the test site.

Problems/Corrective Actions:

We determined from aircraft-based imagery that the tracks left by vehicles driving over the White Sands test site could bias our reflectance-based calibrations. During the recent trip to White Sands we collected data to examine the impact of the tire tracks on the retrieved site reflectance. Possible solutions to this problem include carefully characterizing the track's effects and accounting for them in the calibration work, or reverting back to using yokes for reflectance measurements. These solutions were examined and studied on the previously mentioned trip.

Anticipated Actions:

The RSG will travel to White Sands Missile Range from April 29 until May 1 for calibration of SPOT-3 and Landsat 5. This trip affords an excellent opportunity to examine in-flight cross-calibration of separate sensors as both satellites will overfly the site on the same day at less than a 5 degree zenith angle. Because of this opportunity, we will also attempt to collect aircraft-based radiance data.

Gellman will continue work on the mobile lab as well as continuing to investigate mounting the reflectomobile space-frame to the tow vehicle. Nelson will design and construct yokes for use in surface-reflectance measurements and will assemble the sample and hold device. Spyak will continue work on the calibration laboratory facilities especially in the 0.25 to 2.5 micrometer range. Biggar plans to evaluate the Optronic monochromator and design and construct a thermally controlled filter mount for the monochromator. Thome will complete a prototype of the atmospheric correction look-up table code for ASTER. Biggar and Slater are reviewing three ATBDS for the upcoming ATBD Review meetings in May and making five presentations at the MODIS Calibration Plan Review on April 13 and 14 which Slater is chairing. Members of the group will attend the U. S. ASTER Science team meeting April 19-20 and the joint meeting May 24-27.